ONSHORE HYDROGRAPHY OF TIMBALIER BAY, LOUISIANA

by Keith C. Price

ABSTRACT

Synoptic measurements of salinity, temperature, dissolved oxygen, and transparency were made in Timbalier Bay, Louisiana, over a two-year period (1972-1974) to assess the effects of petroleum-related activities upon these parameters. A total of 214 stations was sampled. No measurable effects attributable to such activities were found. Seasonal effects during the study period accounted for the greatest variations observed.

INTRODUCTION

Gulf South Research Institute (GSRI), under my direction, provided the inshore sampling platform for most of the OEI investigations and collected the inshore hydrography data. Investigators occupied a series of common stations, and in addition many investigators occupied extra stations chosen specifically to complement their research.

Measurements of water depth were made at each station. Conductivity (millimhos/cm), salinity (ppt), temperature (° C), dissolved oxygen (ppm), and light transmissivity (%) were measured near the surface and near the bottom at each station.

METHODS AND MATERIALS

Water depth at each station was measured with a fathometer to the nearest half-foot. Conductivity was measured with an electrodeless

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salinometer having a minimum level of detection of 0.5 millimhos/cm and an accuracy of ± 0.5 millimhos/cm. Salinity was measured with the same electrodeless salinometer to an accuracy of ± 0.3 ppt and a minimum level of detection of zero ppt. Temperature was also measured with the same electrodeless salinometer to an accuracy of ± 0.2° C. Dissolved oxygen levels were determined using a YSI model 51 oxygen meter with temperature and salinity corrections. The percentage of transmittance of light was also measured at each station.

The operating procedure at each station was to measure the hydrographic parameters as the various investigators on board collected samples for their individual research projects. Temperature, salinity, and conductivity were measured near the surface and near the bottom. Temperature and salinity corrections were then set on the oxygen meter and dissolved oxygen levels were measured near the surface and near the bottom. In those cases where the oxygen meter malfunctioned, water samples were collected with a Van Dorn sampler and the dissolved oxygen concentration was determined using the sodium azide modification of the Winkler method.

The bay area was sampled in July 1972, September-October 1972, December 1972, January-February 1973, April 1973, July 1973, October 1973, and January 1974.

RESULTS

The results obtained in this study agree generally with those reported by Barrett (1971) in the Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana. In general, the Timbalier Bay area is less influenced by riverine activities than are other bays along the Central Gulf Coast. Salinities are higher and more stable, and there are fewer fluctuations in most of the other hydrographic parameters.

Salinity

The seasonal variability in salinity is shown in figure 1. This figure shows the data from all stations and all depths averaged together. The minimum figure for salinity was 10.1 ppt, while the maximum was 35.9 ppt. The effects of the 1973 flood can be seen clearly beginning in April 1973; salinities were depressed and far more variable than had been observed in previous surveys.

The spatial variability of salinity and the other parameters was analyzed by grouping the stations into five geographical areas (figure 2). Sector 1 includes all inner bay stations. Sector 2 is a mid-bay area in western Timbalier Bay and includes the platform area around Philo Brice Islands. Sector 3 is a mid-bay zone in eastern Timbalier Bay and includes

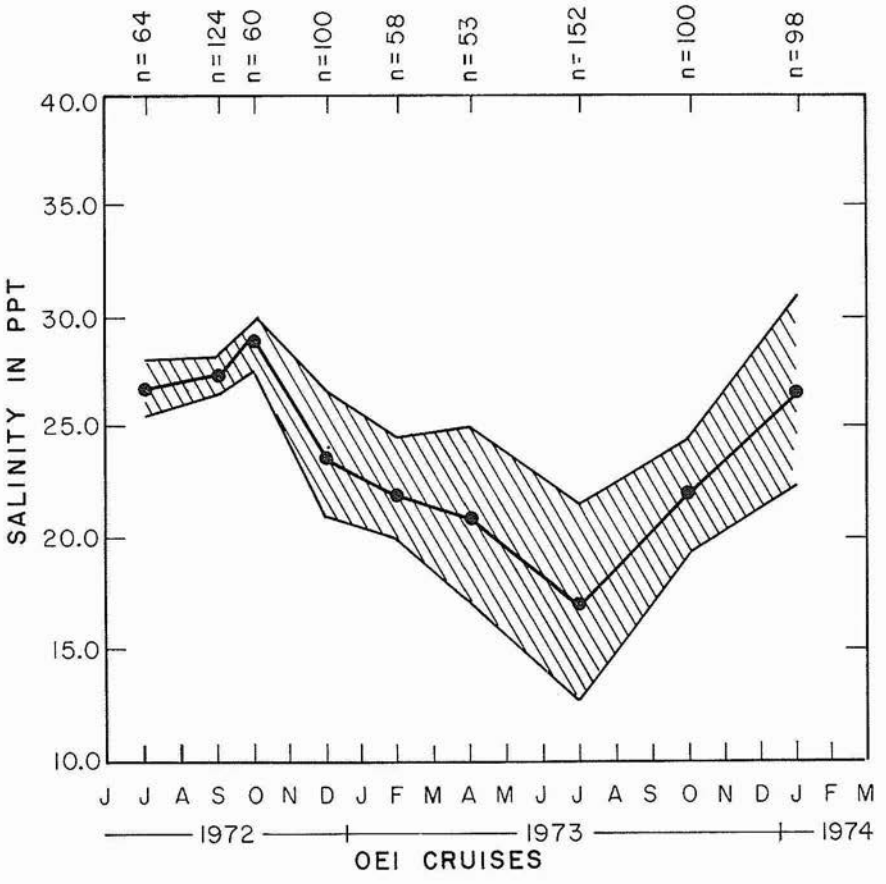

FIG. 1. TIMBALIER BAY SALINITY.

a control site. Sector 4 is the lower mid-bay region on the west and includes another control site. Sector 5 is the bay mouth area and includes the workover rig location where many samples were taken.

Sectors 2, 3, and 4 were very similar in salinity (figure 3). The mean value for all three sectors was near 24 ppt, and the minimum and maximum values were also similar, though they increased slightly from sector 2 to sector 4. Sector 1, the inner bay, had significantly lower salinities, with a mean of approximately 16 ppt and lower minimum and maximum figures than the other zones. Sector 5, the bay mouth, had slightly higher mean and maximum salinity values than the other sectors, but recorded a minimum figure lower than that recorded in sector 4. Examination of the data from individual cruises showed a similar pat-

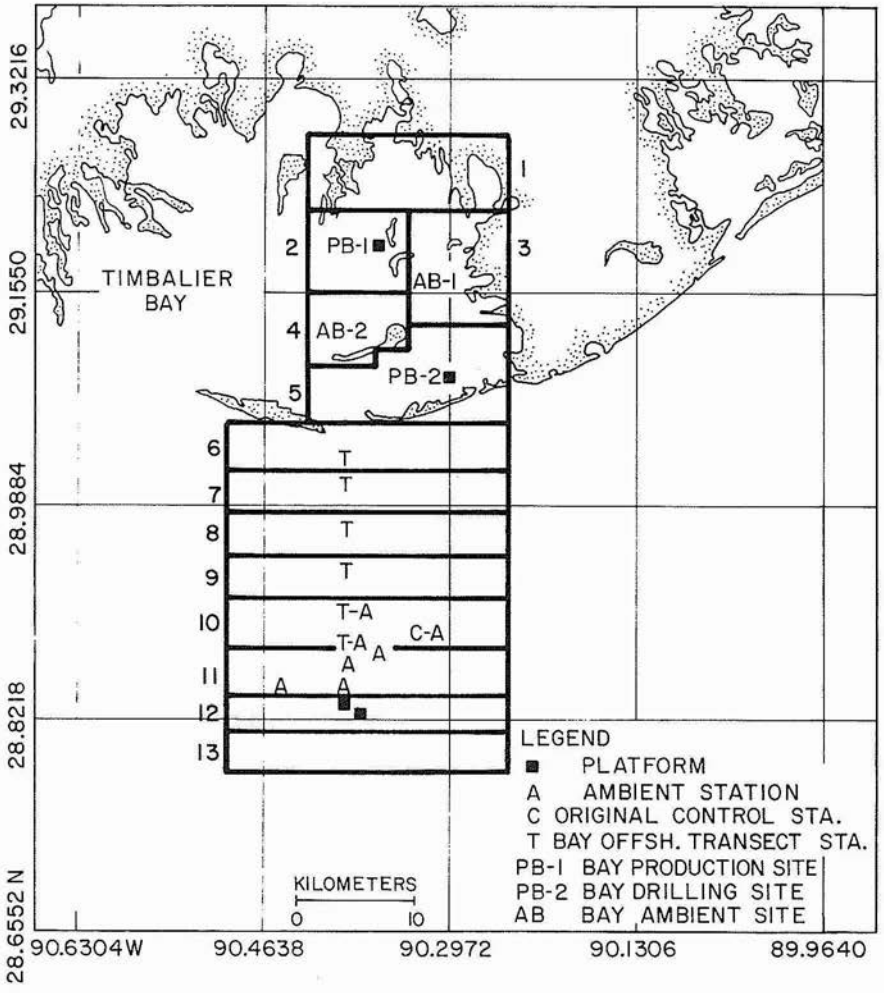

FIG. 2. GEOGRAPHICAL AREA OF THE OEI SHOWING DIVISION INTO SECTORS.

tern, though the mean values for sector 4 sometimes equaled or exceeded the mean values in sector 5.

Water temperature

Water temperatures varied in a manner typical for that area of coastal waters, with maximums in late summer and minimums in late winter (figure 4). The lowest temperature recorded was 8.0° C in September 1972. Spatial variability in water temperatures was minimal,

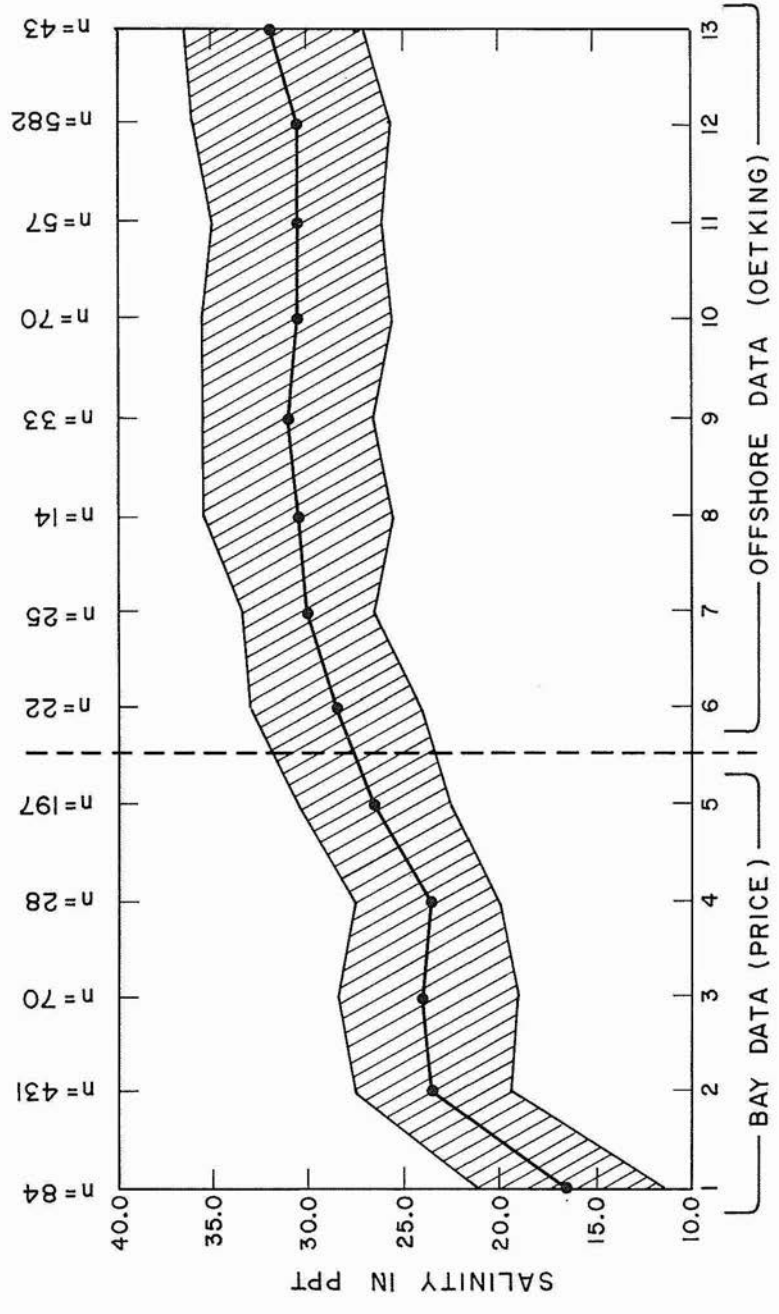

FIG. 3. BAY-OFFSHORE TRANSECT SALINITY.

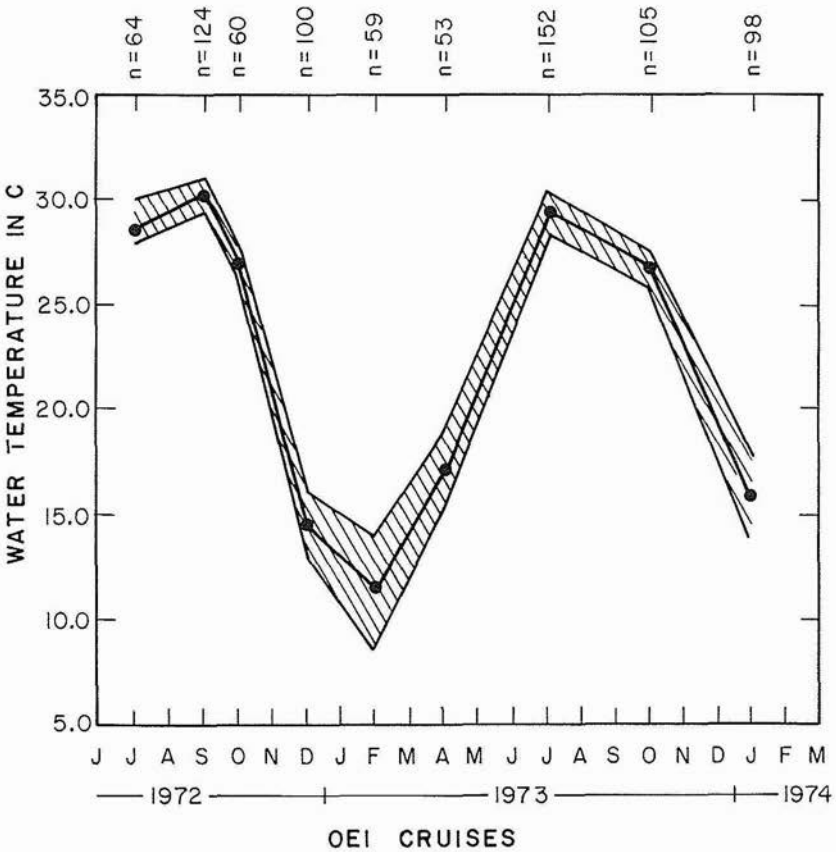

FIG. 4. TIMBALIER BAY WATER TEMPERATURE.

though the shallower, more inshore stations were more variable and more affected by the prevailing air temperatures (figure 5).

Dissolved oxygen

Dissolved oxygen concentrations showed more variability than would normally be expected. The highest readings, 13+ ppm, occurred in the winter months, and the lower reading, 1.3 ppm, occurred in July 1973 (figure 6). Mean values ranged from slightly less than 6.0 ppm to almost 11.0 ppm, except for the July 1973 cruise when the mean value was near 3.5 ppm. These low oxygen levels coincide with the flood of 1973.

The mean dissolved oxygen concentrations exhibited little spatial variability (figure 7). Sector 1, with a mean dissolved oxygen concentration of approximately 5.0 ppm, was the lowest, and sector 2, with

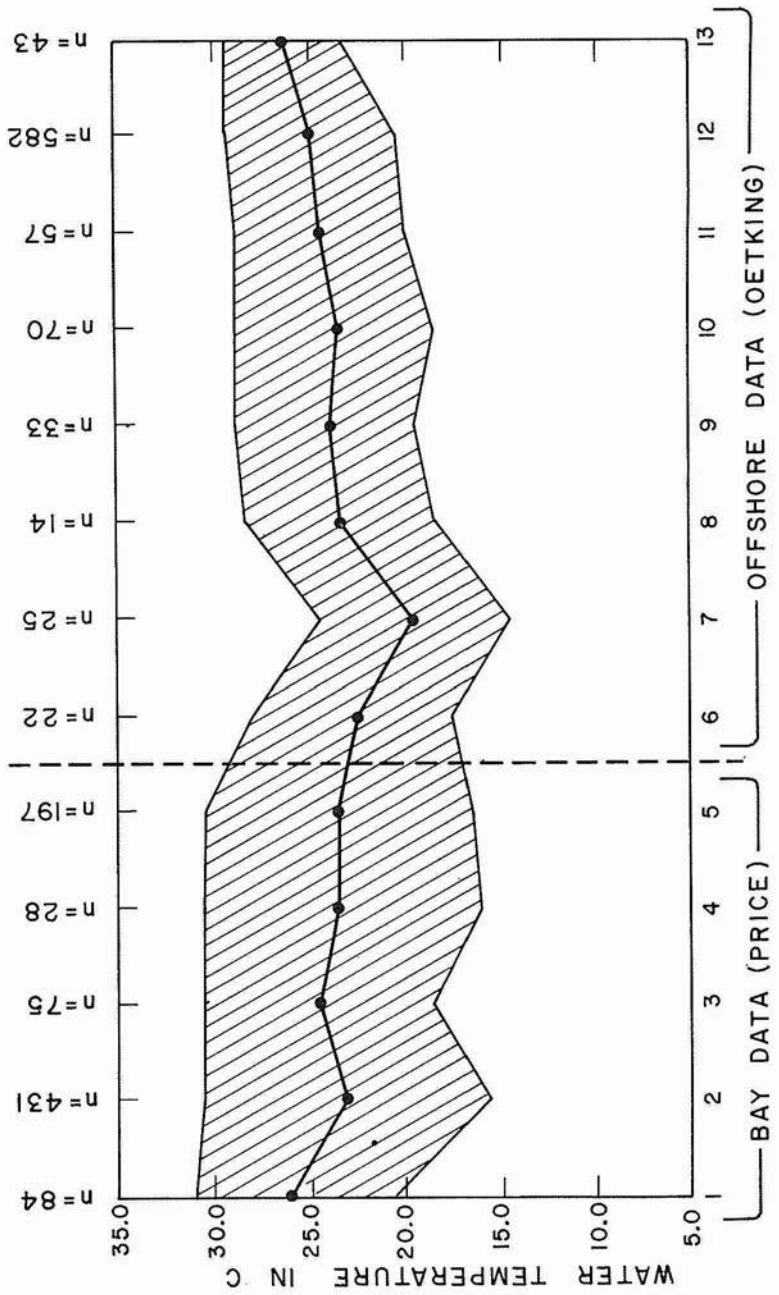

FIG. 5. BAY-OFFSHORE TRANSECT WATER TEMPERATURE.

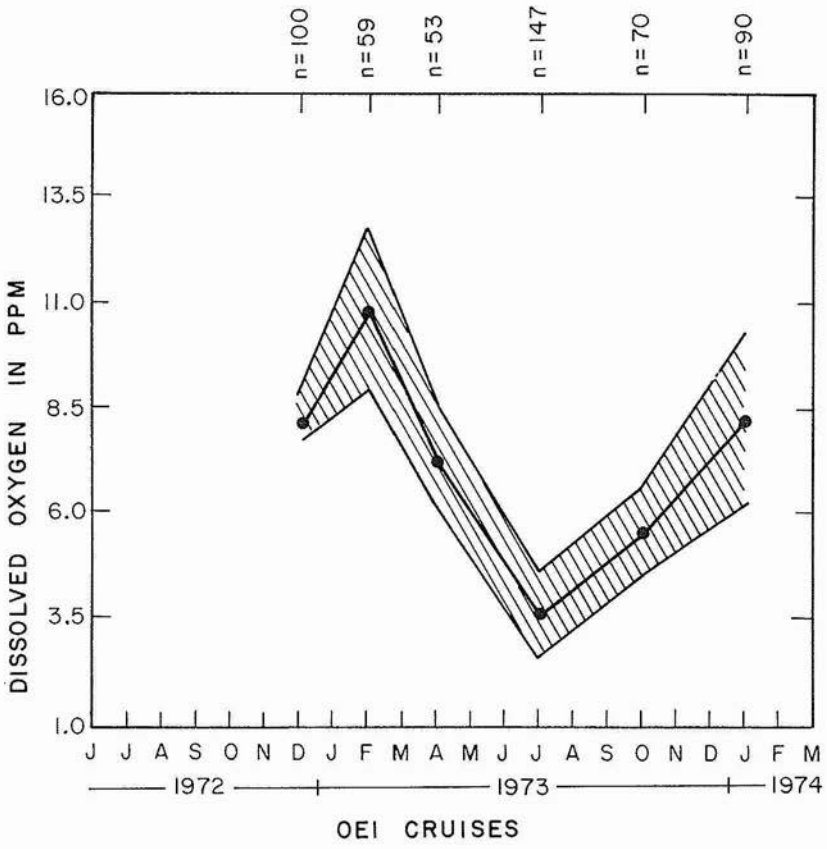

FIG. 6. TIMBALIER BAY DISSOLVED OXYGEN.

a mean of approximately 7.0 ppm, was the highest. Sectors 3, 4, and 5 all had mean dissolved oxygen values near 6.0 ppm. Examination of the mean dissolved oxygen values for the January 1973 and 1974 cruises and the July 1973 cruise also shows limited spatial variability (figure 8). The two winter cruises showed the mean dissolved oxygen values to be below the average for all stations in January 1973 and January 1974, though the mean for sector 1 in January 1973 was not the lowest mean of any of the sectors. The July 1973 data showed minimal variation in the mean value of any sector, the average value being below 4.0 ppm in all five sectors.

Transmissivity

Transmissivity showed a different seasonal pattern from that

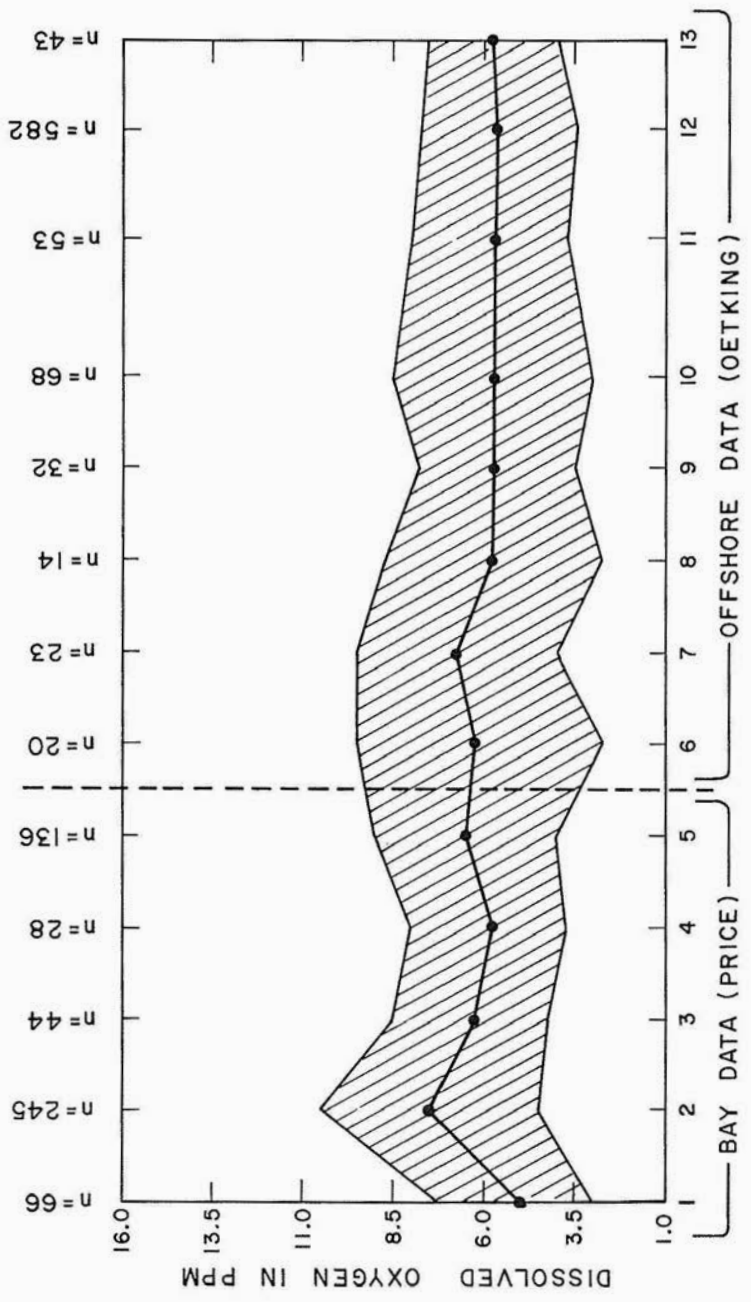

FIG. 7. BAY-OFFSHORE TRANSECT DISSOLVED OXYGEN.

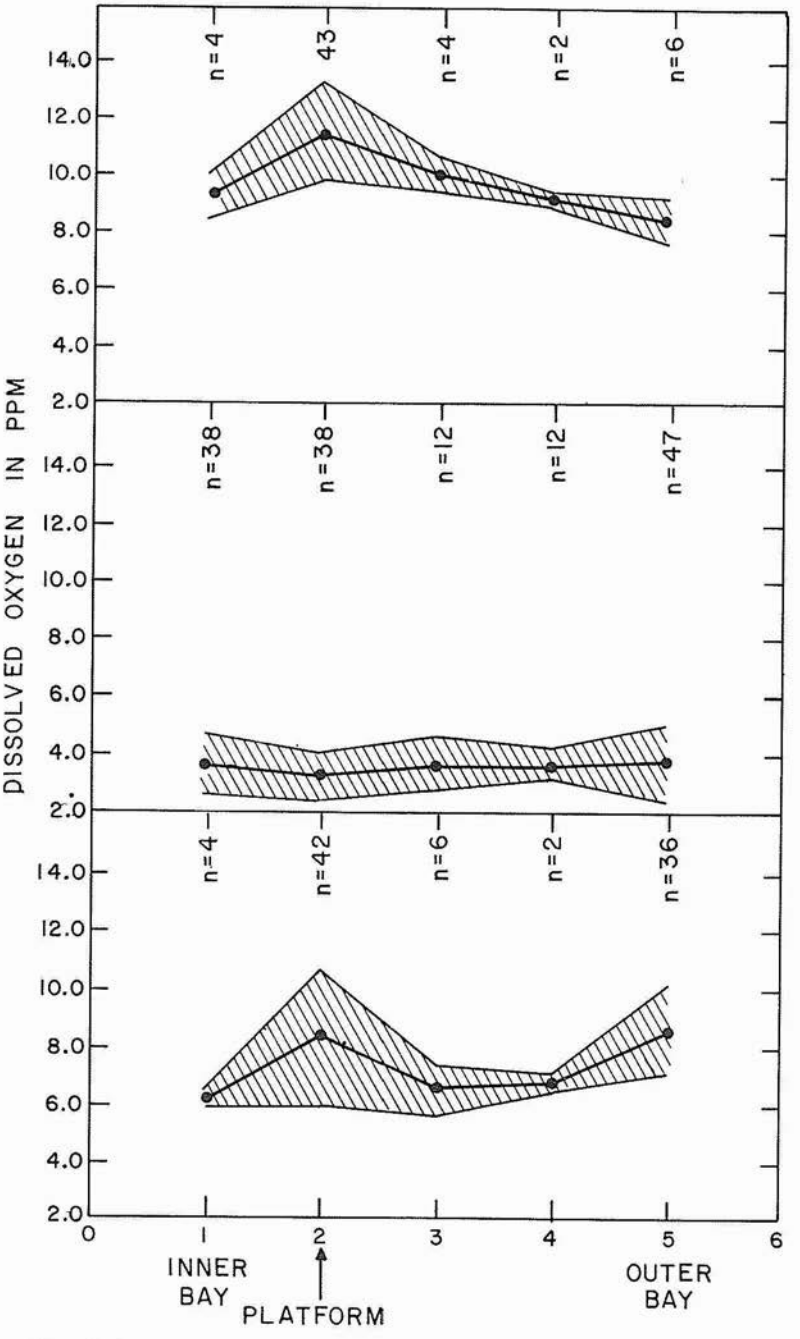

FIG. 8. INNER BAY-OUTER BAY TRANSECT DISSOLVED OXYGEN.

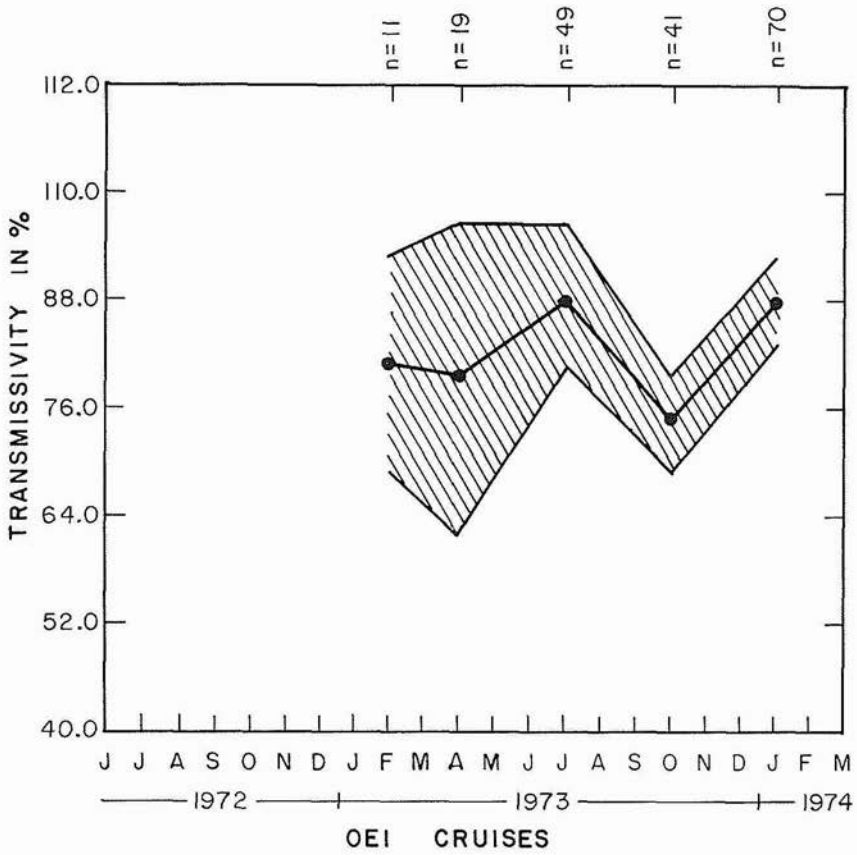

FIG. 9. TIMBALIER BAY TRANSMISSIVITY.

exhibited by the other parameters (figure 9). The maximum (99%) and highest mean (88%) were observed during the July 1973 cruise, which occurred during the 1973 flood. These same high transmittance values were nearly duplicated during the January 1974 cruise. Mean values during other seasons varied from approximately 76% to 80%. The lowest transmissivity, a reading of 42%, occurred during the April 1973 cruise.

Transmissivity had the lowest mean values at the two most inshore sectors (sectors 1 and 2) with mean values near 80% (figure 10). Transmissivity increased through sectors 3, 4, and 5, reaching a mean value of 88% in sector 5. High transmittance values were, however, recorded in all sectors, with values of 94% or greater being recorded from each sector.

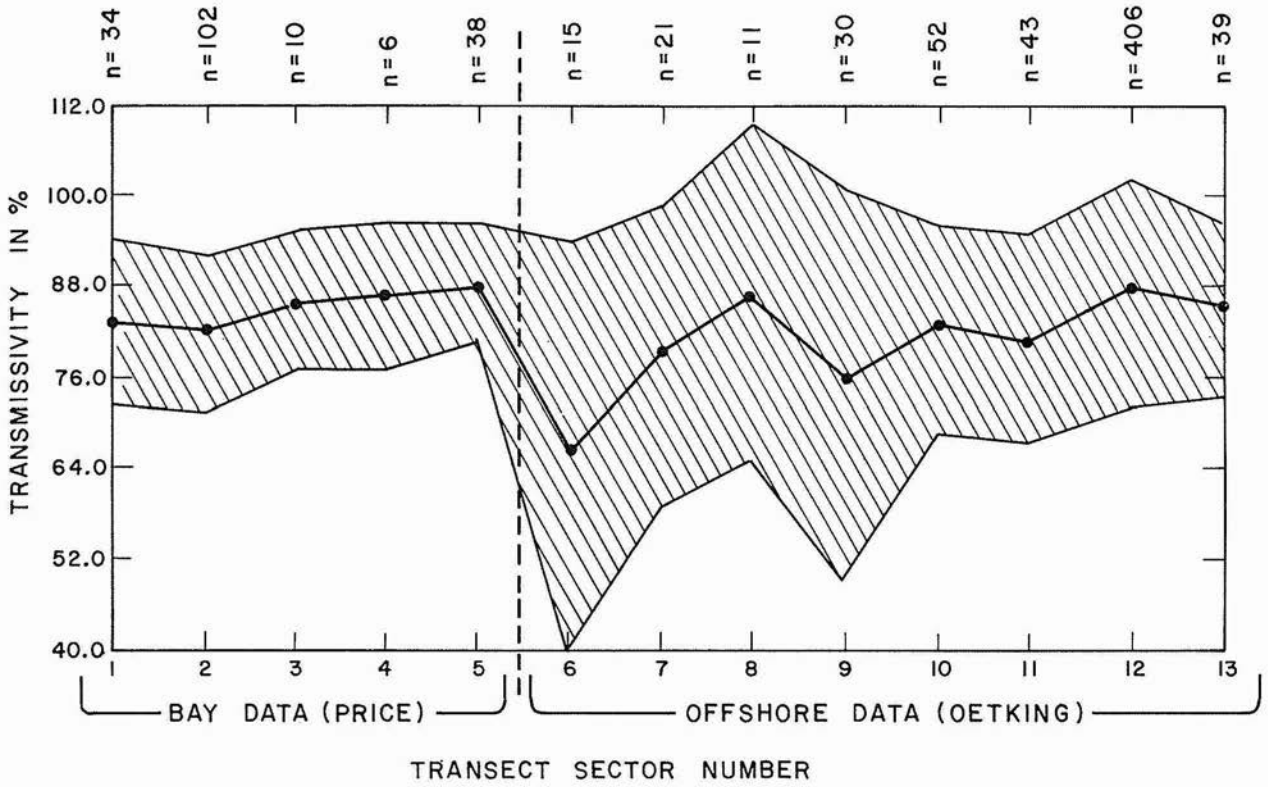

FIG. 10. BAY-OFFSHORE TRANSECT TRANSMISSIVITY.

DISCUSSION AND CONCLUSIONS

The hydrographic data from Timbalier Bay show the bay to be similar to many other bays along the Central Gulf Coast. It differs in that it is normally less affected by large rivers than are most bays and is thus more saline. Timbalier Bay shows less seasonal and spatial variability than is typical. The greater homogeneity resulting from this condition increases its value for the OEI experiments.

The major variation from normal conditions observed during this study was the major flood during the spring and summer of 1973. This flood affected Timbalier Bay despite the paucity of streams entering the bay and despite its relative isolation from the Mississippi River and the Atchafalaya River. As a result, some hydrographic conditions observed during this period were not typical of an average yearly cycle.

ACKNOWLEDGMENTS

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REFERENCE CITED

Barrett, B. 1971. Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana—Phase II, Hydrology and Phase III, Sedimentology. Louisiana Wildlife and Fisheries Commission.